THAT WHICH IS CLAIMED:

1. A modular cell culture bioreactor apparatus, said apparatus comprising:

a plurality of cell culture chambers;

at least one reservoir containing a cell support medium;

a plurality of conduits fluidly connecting said at least one reservoir with said plurality of chambers; and

at least one pump fluidly connected through said plurality of conduits with said at least one reservoir and with said plurality of chambers to pump cell support medium therethrough;

wherein each individual chamber of said plurality of chambers includes at least one three-dimensional matrix comprising polyethylene terephthalate, a plurality of channels carrying the cell support medium and having said matrix positioned in fluid communication therebetween, and at least two openings into each said channel, wherein a first said opening is in fluid connection with said pump and a second said opening is in fluid connection with said reservoir.

2. The apparatus of claim 1, wherein said plurality of cell culture chambers comprises individual chambers fluidly connected in parallel.

3. The apparatus of claim 1, wherein said matrix further comprises a nonwoven fibrous matrix of polyethylene terephthalate having a random microscopic structure.

4. The apparatus of claim 1, wherein said matrix has a thickness ranging from approximately 0.5 mm to 2.0 mm.

5. The apparatus of claim 1, wherein said matrix has a void to total volume ratio greater than approximately 0.8.

6. The apparatus of claim 1, wherein said cell support medium has an oxygen tension ranging approximately from 1% up to 20%.

7. The apparatus of claim 1, wherein said at least one pump generates a cell support medium flow rate of at least approximately 0.4 ml per minute through said bioreactor.

8. The apparatus of claim 1, wherein said cell support medium has pH ranging approximately from 7.0 to 7.4.

9. The apparatus of claim 1, wherein each individual chamber of said plurality of chambers comprises a valve positioned to control fluid flow through each said opening into each channel.

10. The apparatus of claim 1, wherein each individual chamber of said plurality of chambers comprises a valve positioned to shut off fluid flow to each said opening into each channel so as to permit each individual chamber to be disconnected and removed from the bioreactor.

11. The apparatus of claim 1, further comprising means for maintaining a temperature effective for cell culture.

12. The apparatus of claim 1, wherein each individual chamber of said plurality of chambers further comprises a water jacket along an outer periphery of said chamber.

13. The apparatus of claim 12, wherein said water jacket is in fluid connection with a water reservoir having a heater associated therewith for maintaining the water at a temperature effective for cell culture.

14. The apparatus of claim 1, wherein each individual chamber of said plurality of chambers further comprises a jacket along an outer periphery of said chamber, said jacket circulating a heat transfer fluid around said chamber.

15. The apparatus of claim 14, wherein said jacket is in fluid connection with a heat transfer fluid reservoir having a heater associated therewith for maintaining the fluid at a temperature effective for cell culture.

16. A method of seeding and culturing cells, the method comprising:

seeding the cells by generating a flow of medium carrying an inoculum containing cells through a three-dimensional nonwoven fibrous matrix of polyethylene terephthalate so as to filter the medium therethrough at a flow rate effective for permitting adherence of predetermined cells to the matrix;

diverting the flow of medium after filtering so that the diverted medium flows primarily along outer peripheries of the matrix; and

culturing the adherent cells by perfusing the diverted flow of medium to contact the outer peripheries of the matrix at a flow rate effective for allowing diffusion of cell nutrients and cell waste products through the matrix.

17. The method of claim 16, further comprising removing non-adherent cells from the medium after seeding.

18. The method of claim 16, wherein the inoculum consists of a sample of human bone marrow.

19. The method of claim 16, wherein the inoculum contains human mesenchymal stromal cells.

20. The method of claim 16, wherein the inoculum contains human hematopoietic stem cells.

21. The method of claim 16, wherein filtering and diverting are carried out within a single cell culture chamber.

22. The method of claim 16, wherein filtering and diverting are carried out substantially simultaneously in a plurality of cell culture chambers.

23. The method of claim 16, wherein filtering and diverting are carried out without handling the matrix.

24. A method of seeding and culturing cells, the method comprising:

seeding the cells by generating a flow of medium carrying an inoculum containing cells through a three-dimensional nonwoven fibrous matrix of polyethylene terephthalate so as to filter the medium therethrough at a flow rate effective for permitting adherence of predetermined cells to the matrix;

monitoring cell count in the filtered medium as an indicator of cell adherence to the matrix and continuing filtration until a predetermined proportion of cells has adhered;

diverting the flow of medium after filtering so that the diverted medium flows primarily along outer peripheries of the matrix; and

culturing the adherent cells by perfusing the diverted flow of medium to contact the outer peripheries of the matrix at a flow rate effective for allowing diffusion of cell nutrients and cell waste products through the matrix.

25. The method of claim 24, further comprising removing non-adherent cells from the medium after seeding.

26. The method of claim 24, wherein the inoculum consists of a sample of human bone marrow.

27. The method of claim 24, wherein the inoculum contains human mesenchymal stromal cells.

28. The method of claim 24, wherein the inoculum contains human hematopoietic stem cells.

29. The method of claim 24, wherein filtering and diverting are carried out within a single cell culture chamber.

30. The method of claim 24, wherein filtering and diverting are carried out substantially simultaneously in a plurality of cell culture chambers.

31. The method of claim 24, wherein filtering and diverting are carried out without handling the matrix.